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INNOVATIVE TEACHING METHODS FOR ISCHEMIC HEART DISEASE IN MEDICAL EDUCATION

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Abstract
Ischemic heart disease (IHD) remains one of the leading causes of mortality and disability worldwide. Therefore, the quality training of future physicians who are capable of timely diagnosis and effective treatment of this condition is of particular importance. Modern medical education requires the integration of innovative teaching methods aimed at developing clinical thinking, practical skills, and the ability to make informed decisions in settings that closely simulate real clinical practice. Interactive technologies, simulation-based learning, virtual patients, problem-based learning (PBL), and case-based teaching have become integral elements of the educational process in the training of cardiology specialists. The implementation of these approaches not only enhances students' motivation but also ensures a deeper understanding of the pathogenesis, diagnosis, and treatment principles of ischemic heart disease. The aim of this article is to review and analyze innovative teaching methods for IHD in medical education and to assess their effectiveness and prospects for further development.

Keywords: Ischemic heart disease; medical education; innovative teaching methods; simulation-based learning; virtual patients; problem-based learning (PBL); cardiology education; clinical thinking; interactive technologies; competency-based approach, cased-based learning., artificial intelligence

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Introduction:

Coronary heart disease (CHD) is a group of diseases that occur due to insufficient coronary blood flow to the heart muscle, leading to myocardial ischemia. Atherosclerosis, thrombosis, spasms and microvascular dysfunctions play an important role among the causes of coronary heart disease. Clinically, the disease can manifest as angina pectoris, myocardial infarction, heart failure, or sudden cardiac death. A violation of the blood supply to the myocardium leads to a malfunction of the pumping function of the heart, which significantly reduces the quality of life and life expectancy of the patient.

Coronary heart disease is one of the leading causes of death and disability worldwide. There are millions of patients living with this disease in the United States and Europe. Despite the rapid development of medicines, invasive technologies, and preventive measures in recent years, the widespread prevalence of the disease underscores the need for its in-depth study in medical education.

In medical universities, along with traditional approaches, the introduction of modern pedagogical technologies in teaching coronary heart disease is becoming increasingly relevant. An in-depth study of the pathogenesis, clinical manifestations, diagnosis, and treatment methods of the disease plays an important role in converting students' theoretical knowledge into practical skills. Therefore, the use of interactive, problem-oriented and simulation methods in teaching coronary heart disease significantly increases the effectiveness of teaching.

Currently, information and communication technologies, discussion of clinical cases, virtual simulators, role-playing games and multidisciplinary approaches are widely used in the educational process. Such technologies contribute to the development of analytical thinking, the ability to make clinical decisions and independent learning among students.

Materials and research methods

This study analyzed scientific articles, clinical guidelines, textbooks, and meta-analyses published between 2008 and 2024. Scientific data was studied using sources such as ScienceDirect, PubMed, Google Scholar, eLibrary, SpringerLink,

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and others. The main attention was paid to modern approaches in teaching coronary heart disease — interactive methods, simulations, problem-based learning and the impact of digital technologies on the educational process. In total, about 25 articles were selected, in which the methods considered were evaluated in terms of their effectiveness.

The Main Part:

Coronary heart disease (CHD) is currently one of the most common cardiovascular diseases in the world, characterized by high mortality and disability. Taking into account the complex pathophysiology of this disease, the variety of its clinical forms (angina pectoris, myocardial infarction, heart failure, sudden cardiac death), as well as the need for an integrated approach to treatment, it becomes obvious the need for a deep and systematic study of coronary heart disease in the framework of medical education. Traditional teaching methods are focused primarily on theoretical knowledge, while modern methods are aimed at developing students' clinical thinking, decision-making skills and practical skills. In recent years, interactive, problem-oriented, simulation and digital technologies have been actively introduced into the educational process, which make it possible to more effectively assimilate the pathogenesis, clinical manifestations, diagnosis and principles of treatment of coronary heart disease not only in theory, but also in practice. One of the effective approaches is case-based learning. This method develops students' ability to apply theoretical knowledge to real clinical situations, analyze patient complaints, results of laboratory and instrumental studies, discuss treatment tactics and develop informed clinical decisions. Simulation training, or in other words, virtual study of patients with coronary heart disease, is widely used in teaching coronary heart disease, which makes it possible to simulate real clinical conditions in a safe educational environment. With its help, students master the mechanisms of ischemia, learn to recognize clinical manifestations, manage the patient's condition, and develop individual therapy strategies. Simulation helps to form the most important practical skills: making a diagnosis, prescribing medications, and developing a treatment plan. Digital technologies have become an integral part of medical education. The use

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of virtual simulators, augmented reality (AR), 3D models of the heart, mobile applications (for example, Medscape, UpToDate), electronic textbooks and modules for clinical decision-making based on artificial intelligence significantly improves the quality of learning. With the help of virtual models, students can visualize heart attack zones, coronary blood flow disorders, and pathophysiological processes occurring in coronary artery disease. AR technologies allow for real-time examination of the anatomy of the heart and pathological changes. Currently, it is important to take into account the growing trend in the use of artificial intelligence in medical practice, computing technologies such as artificial intelligence (AI), computational modeling (VM) and augmented reality (AR) are changing the practice of medicine. AI algorithms such as machine learning (MO) and deep learning (GO) simplify data collection, randomization, and processing, as well as enable personalized risk predictions and clinical decision making, and to receive patient-specific data related to the diagnosis and treatment of cardiovascular diseases, in particular coronary heart disease. Thanks to this technology, students studying heart-related diseases improve their understanding of the complex anatomy of the cardiovascular system, thanks to advanced search queries.

A video conferencing platform has also become one of the methods of teaching students, with the help of which there is the possibility of distance learning, scientific conferences, lectures and small group work. Such platforms have provided learning flexibility in time and space, especially for students with high workload. However, in order to increase the effectiveness of virtual learning, it is necessary to adhere to pedagogical principles that ensure student engagement, feedback, and maintenance of learning motivation. Research has shown that excessive use of digital platforms can lead to decreased concentration and engagement in the learning process. Therefore, it is recommended to strengthen the sense of community in the study group, encourage voice discussions and visual contact. In general, modern pedagogical approaches in teaching coronary heart disease contribute not only to the deepening of theoretical knowledge, but also to the formation of students' clinical thinking, analytical abilities, teamwork skills and effective communication. These methods prepare future doctors for

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professional activity, improving their clinical training and contributing to improving the quality of medical care for patients with coronary heart disease.

Conclusion:

The teaching of coronary heart disease using modern methods in medical education is important for the integration of theoretical knowledge with practical skills, as well as for the formation and strengthening of professional competencies of medical students. Through simulation training, situational tasks, digital technologies and interactive approaches, students deeply master the pathophysiology of the disease, diagnostic methods and principles of treatment. These methods not only develop clinical thinking and decision-making skills, but also prepare students for real medical practice. In addition, the introduction of modern pedagogical technologies contributes to improving the quality of medical education and professional training of future doctors.

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